Reconstructing web pages from browser cache

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Demo I

- Open Safari
- Clear Safari's cache
- Visit www.tweakers.net

Criminal research

- planning a crime
- committing the perfect crime
- Internet used as a resource

Evidence by a witness

- looking at content that is against the law
- content is removed by a suspect in a later stage
- Internet used as a resource

Forensic crime investigation

- computer forensics
- browser forensics
- web cache data forensics

Research question

In what ways can one visually reconstruct websites with information retrieved from normalized browser caches that can be use for computer forensic examiners to build a case?

- Raw caching data
- Reconstruction methods
- Reliability after reconstruction

Current forensic web cache tools

- Nirsoft
- Web Cache View
- Digital Detective
- Siquest
- Foxten Software

Netherlands Forensic Institute Tools

- XIRAF
- HANSKEN
- Traces

Popular web browsers

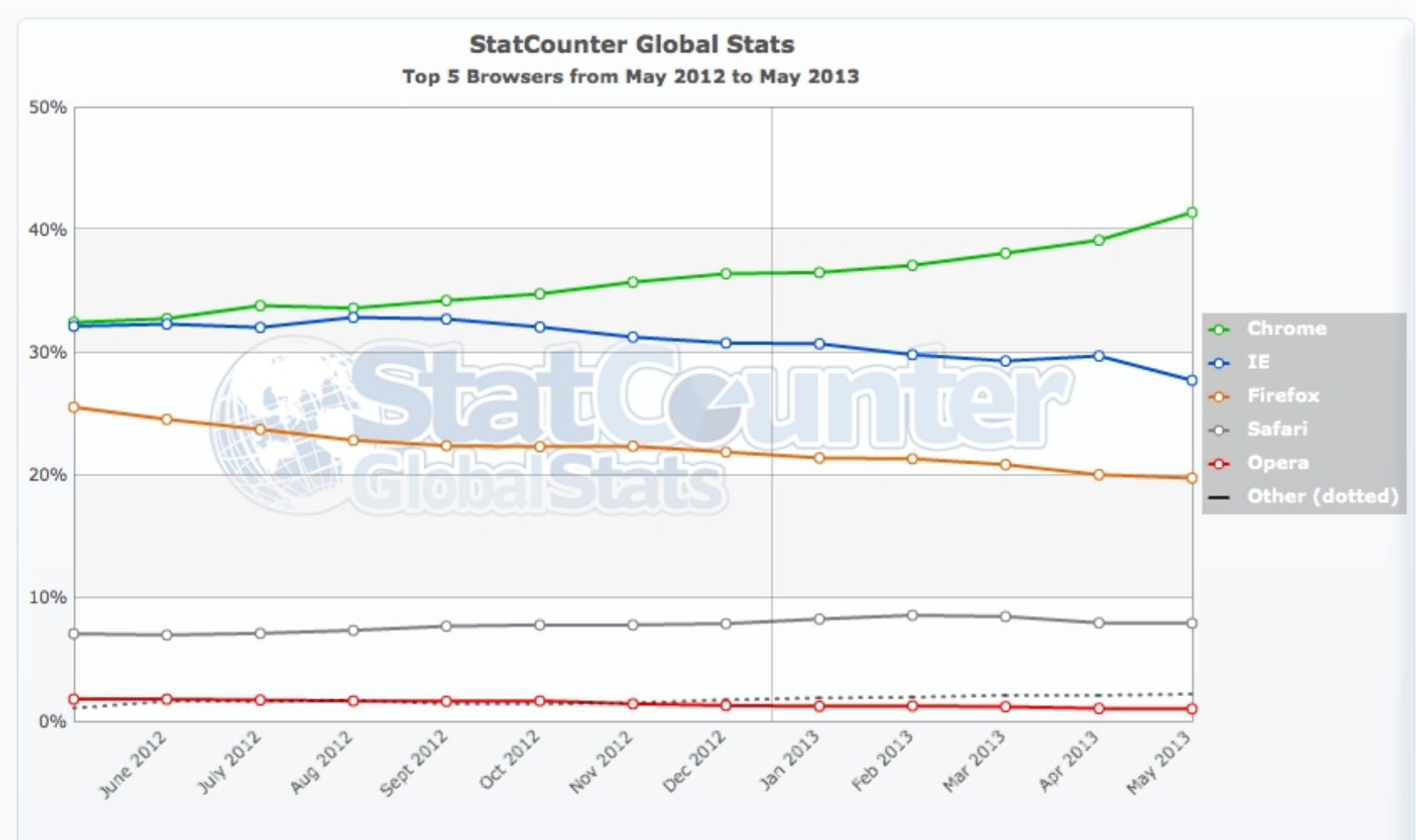


Figure 1 : Browser popularity - Worldwide

Web cache data structure - Google Chrome

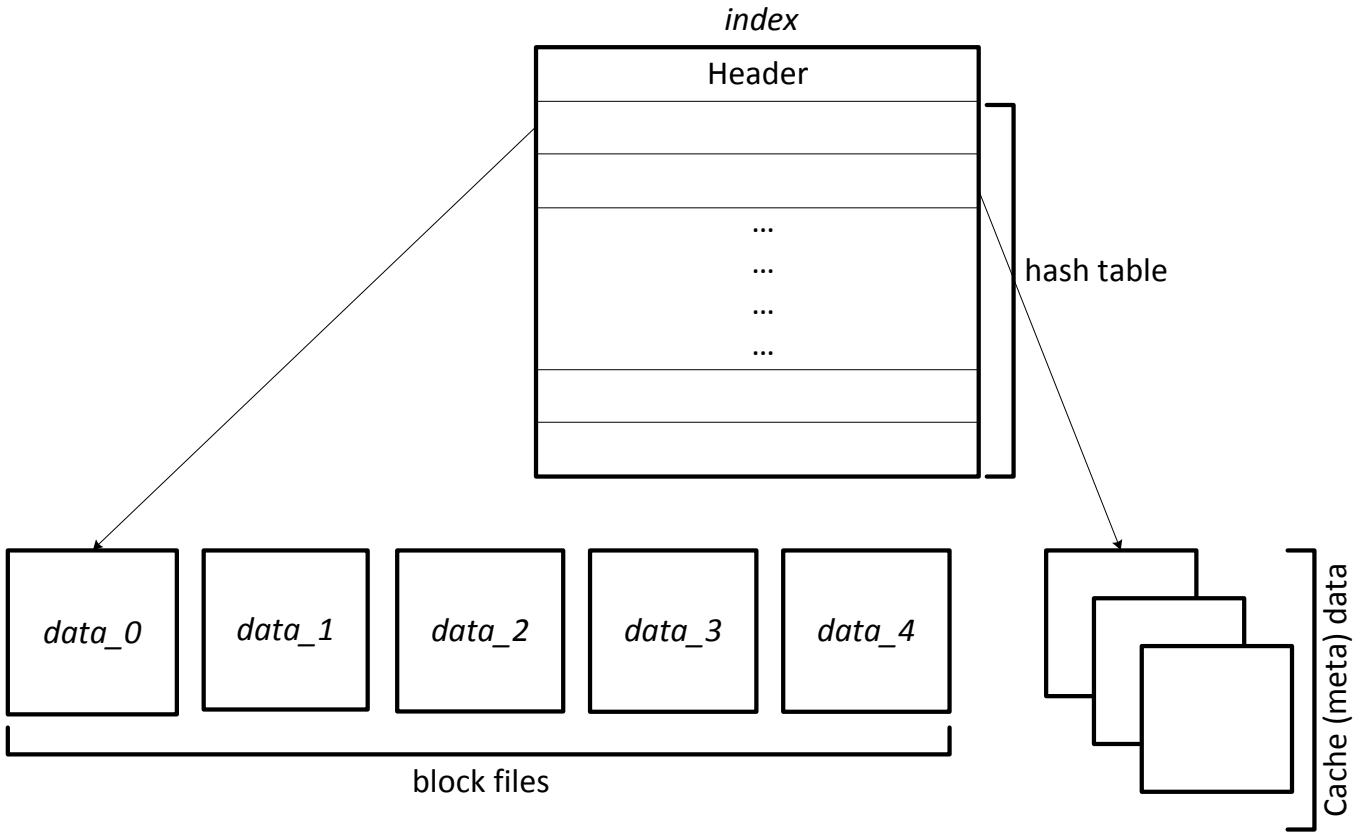


Figure 2 : Chrome web cache structure

Web cache data structure - Mozilla Firefox

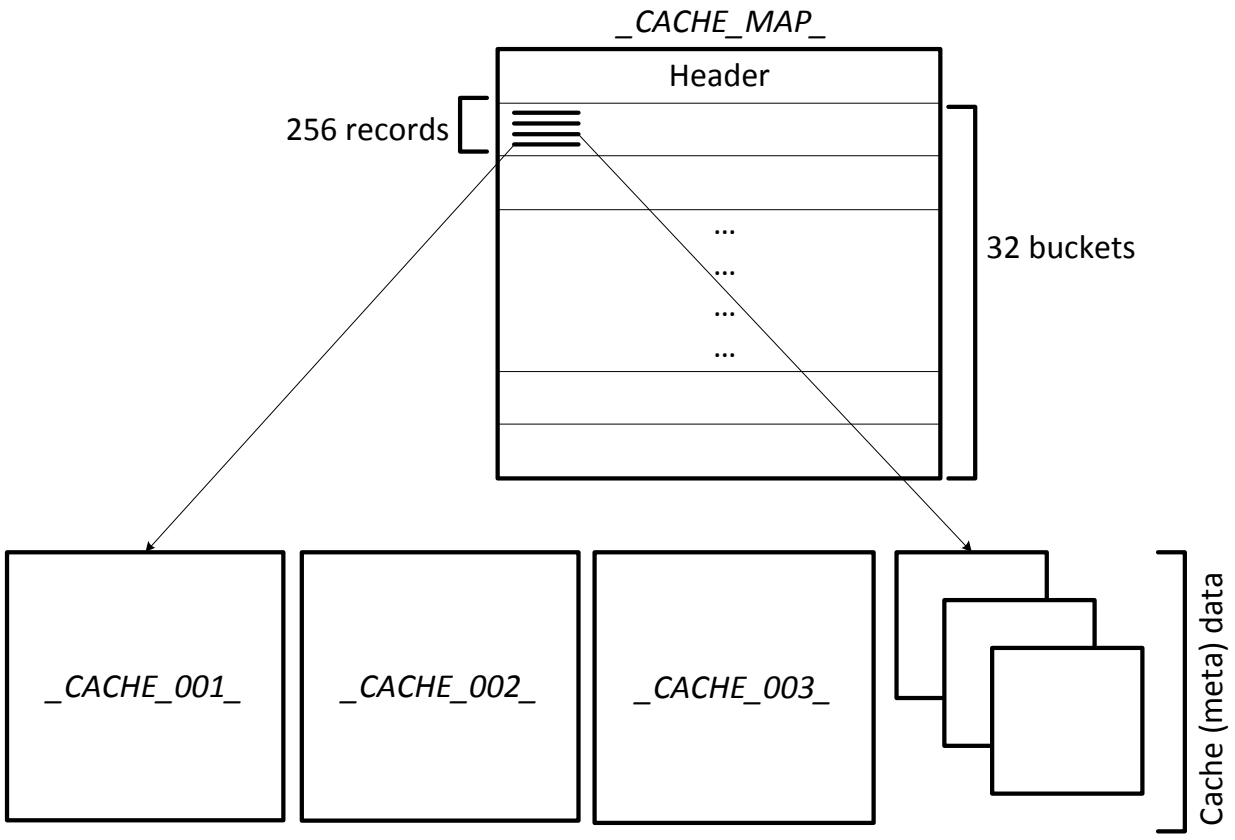


Figure 3 : Firefox web cache structure

Web cache data structure - Apple Safari

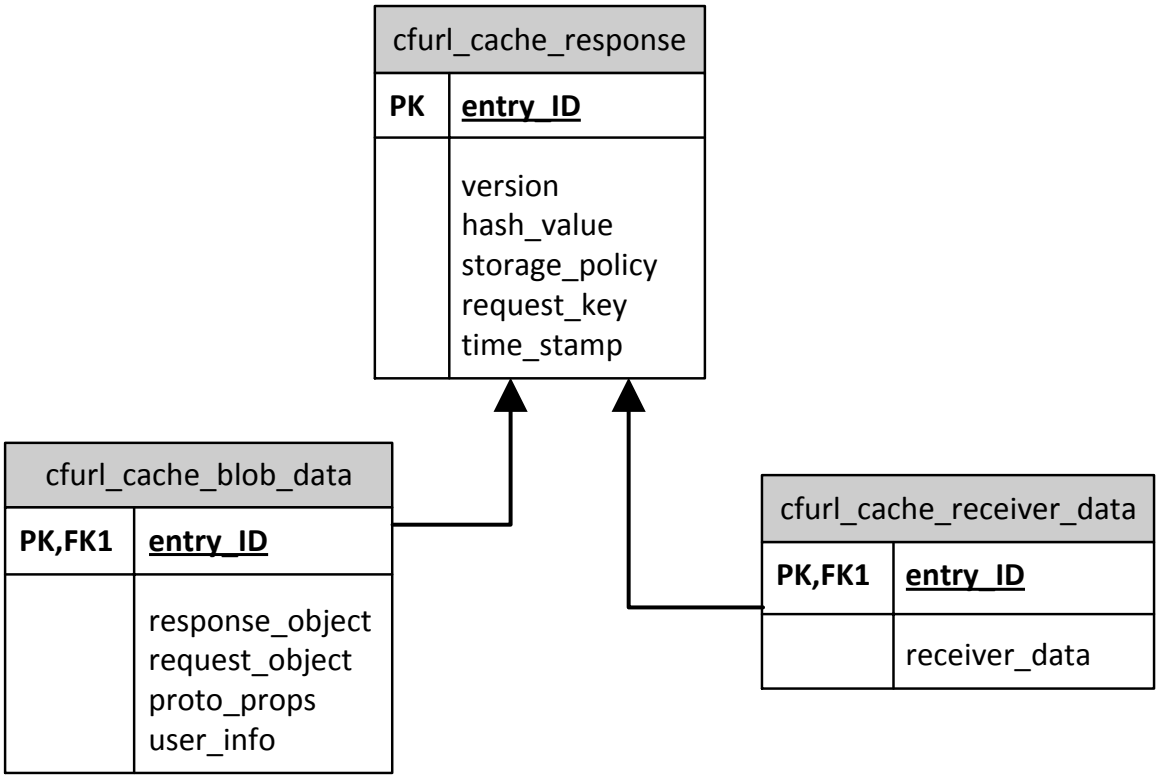


Figure 4 : Safari web cache structure

Web cache data - before sanitazion

	Chrome	**Firefox**	**Safari**
Unique identification	✓	✓	✓
Eviction	✓	✓	X
URL request string	✓	✓	✓
Time/Date (first request)	✓	✓	✓
Time/Date (last request)	X	✓	X
Time/Date (expire)	X	✓	X
Fetch count	X	✓	X
Client request headers	X	X	✓
Server response header	✓	✓	✓
Server response body	✓	✓	✓

Table 1 : Firefox, Chrome and Safari web cache comparison table

Traces - normalised cache data

- Unique identification
- URL request string
- Time/Date (first request)
- Server response body

Web page reconstruction methods - I

- pre-processing
- post-processing

Web page reconstruction methods - II

Pre-processing

- Advantages:
  1. Requires no configuration of the rendering browser.
  2. Can even run in the browser of the user enabling interaction.
- Disadvantages:
  1. Tampering the evidence.
  2. Hard to parse all resource identifiers, especially if JavaScript is used.
  3. Non-parsed resource identifiers are circumventing the application.

Web page reconstruction methods - III

Post-processing

- Advantages:
  1. All resource identifiers are captured by the proxy.
- Disadvantages:
  1. Requires proxy configuration of rendering browser.
  2. SSL traffic is hard to deal with.

Proof of Concept

Proof of Concept

Application design

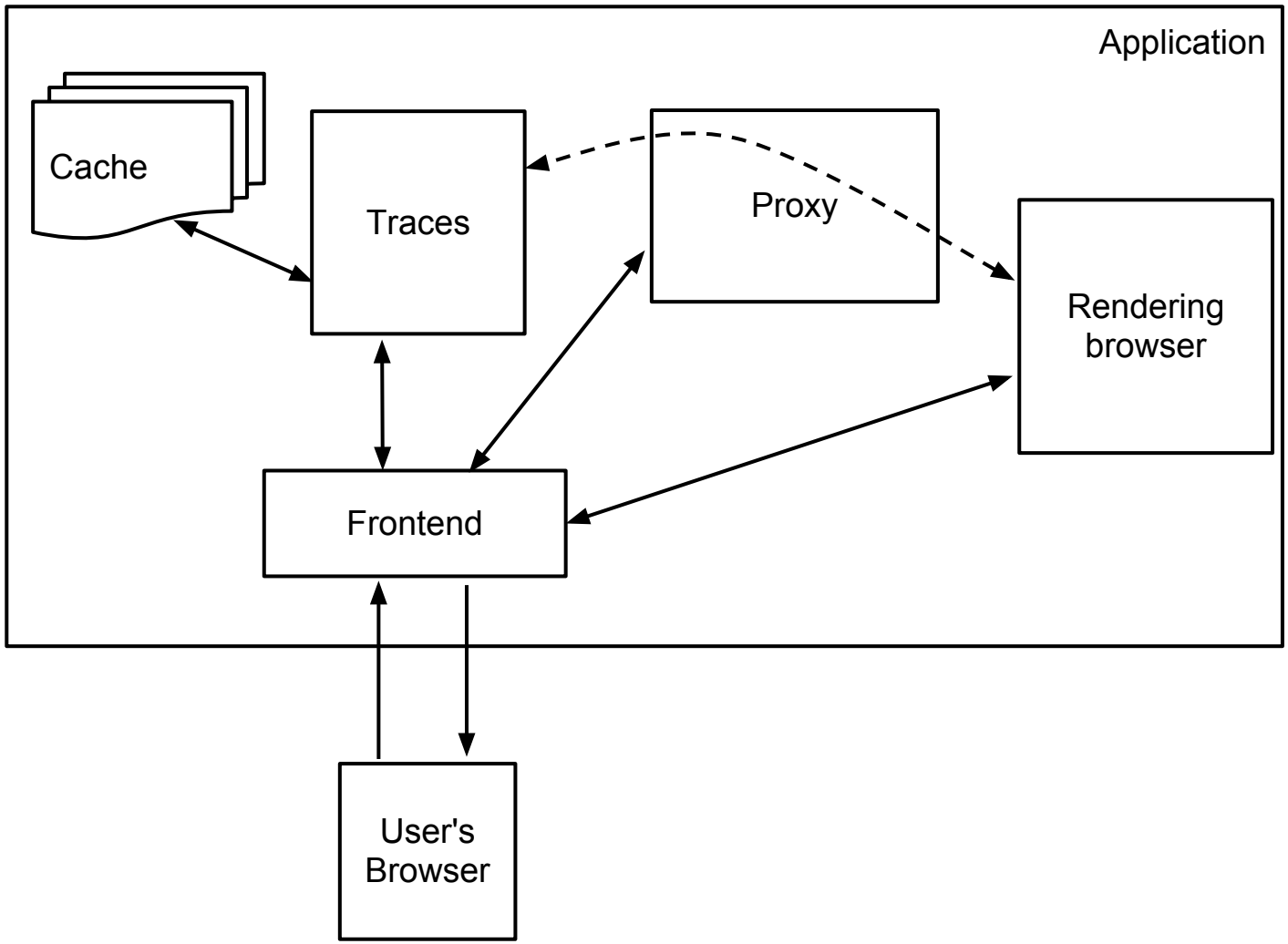
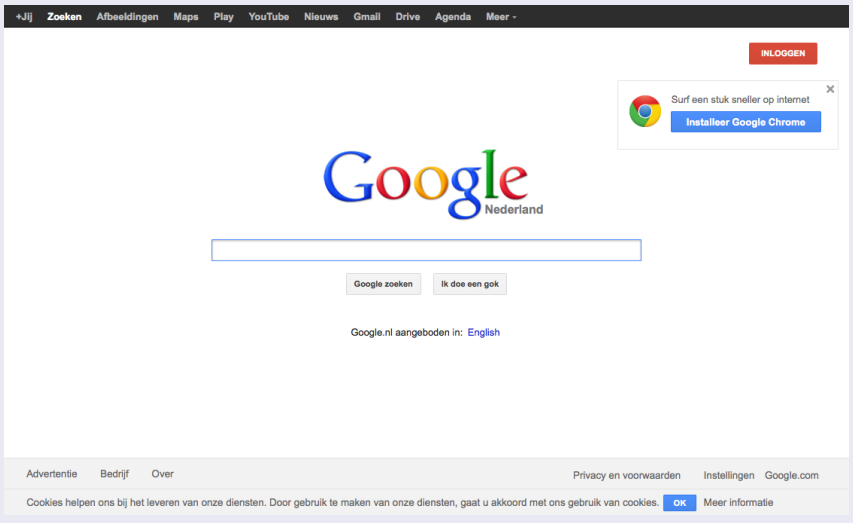


Figure 5 : Web page reconstruction application

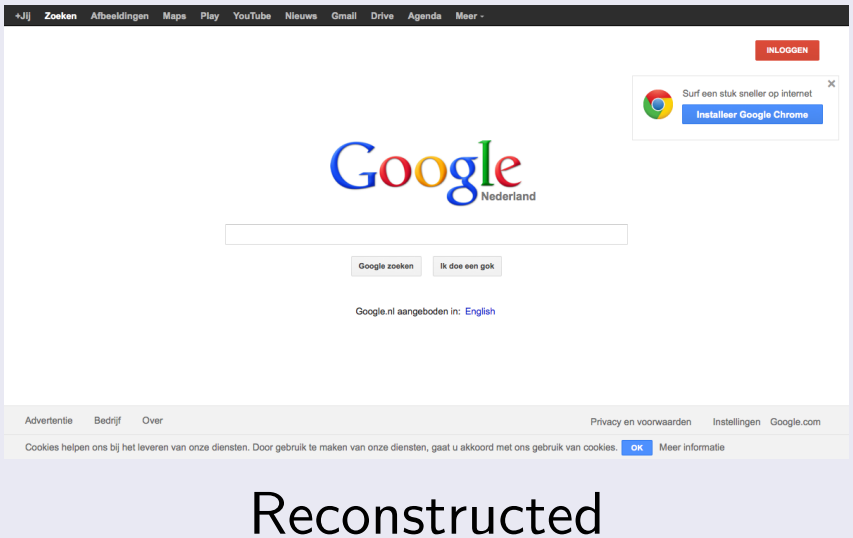
Demo II

- Reconstruct web page visited at the beginning of this presentation
- Compare before and after

Result - Simple websites I

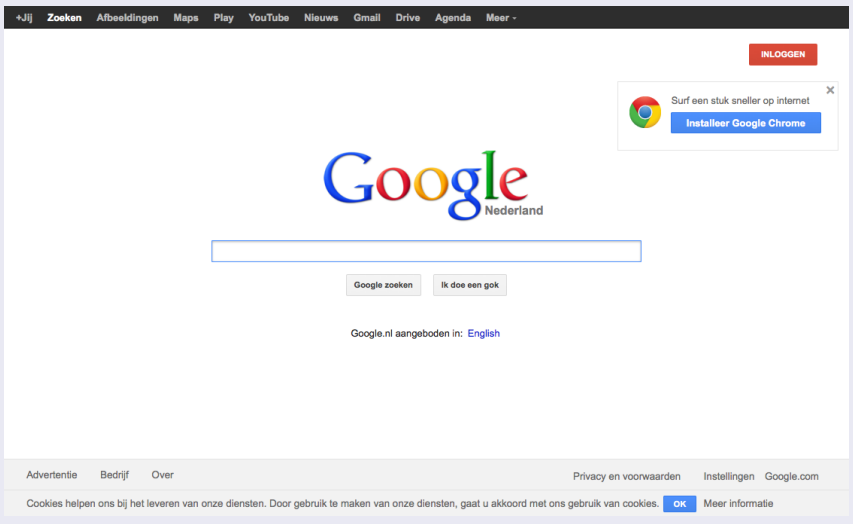


Original

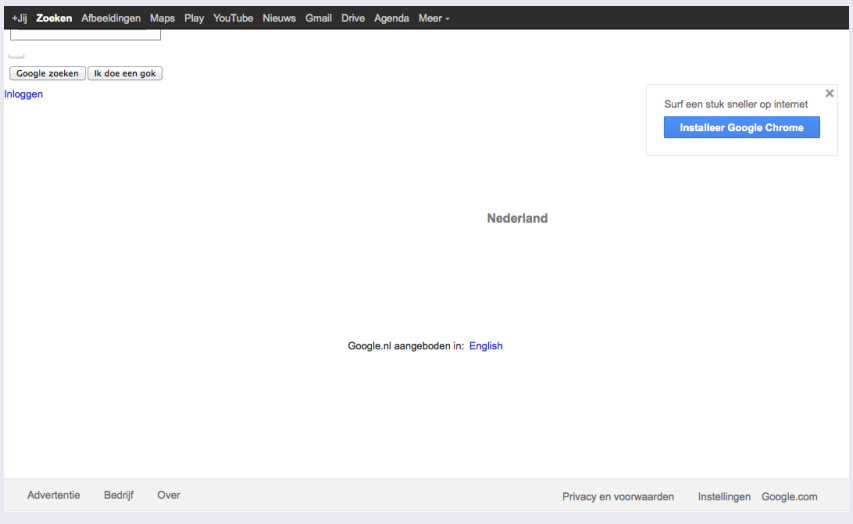


Reconstructed

Result - Simple websites II



Original



NetAnalysis

Result - complex websites I

Original

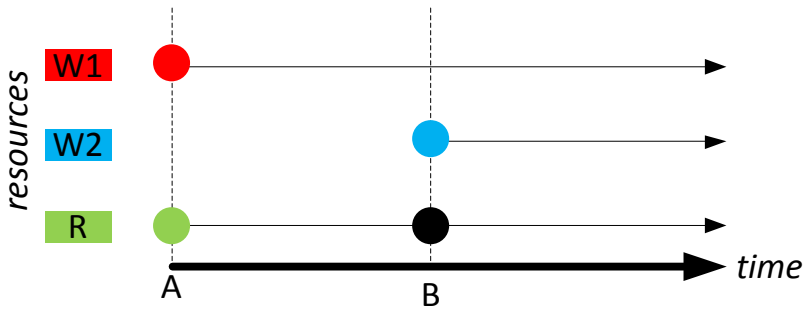
Reconstructed

Result - complex websites II

Original

NetAnalysis

Analysis - Dynamic resources



1. Browser S displays website W1 on time A.
2. Website W1 contains resource R.
3. Browser S displays website W2 on time B.

Analysis - Runtime dependencies

1. Browser S visits website W.
2. Website W contains a dynamic time T.
3. Time T is taken from the local system time.

Conclusion

- Prefer post-processing
- Normalized data is sufficient
- Reliability depends on cache data

Thank you

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